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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/768,195	01/23/2001	Hiroki Endo	KNI-145-A	1960

7590 03/24/2003
CARRIER, BLACKMAN & ASSOCIATES, P.C.
24101 NOVI ROAD #100
NOVI, MI 48375

EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 03/24/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/768,195

Applicant(s)

ENDO ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 13-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 17 July 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

1. This action responds to the Amendment and proposed correction to the drawings filed 17 July 2002 (Paper No 9).

Election/Restrictions

2. Newly submitted claims 13-19 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

The new claims are drawn to a patentably distinct species from the original claims.

Original dependent claims 9-12 are drawn to any organic or inorganic spin-on-glass (SOG) having a dielectric constant of ≤ 3.5 . The new claims 13-19 are drawn to several other species of SOG prepared from specific materials, such as alkoxides. The materials include carbon-containing organic, carbon-containing inorganic, ladder-type, and those formed from organic alkoxide. Moreover, the object of the invention is drawn to keeping the oxygen concentration low during SOG process --not to SOG materials prepared from specific reagents.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 13-19 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 17 July 2002 have been approved. A proper drawing correction or corrected drawings are

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required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

1. Correction of Informalities -- 37 CFR 1.85

New corrected drawings must be filed with the changes incorporated therein. Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin. If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings **MUST** be filed within the **THREE MONTH** shortened statutory period set for reply in the "Notice of Allowability."

Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136 for filing the corrected drawings after the mailing of a Notice of Allowability. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

2. Corrections other than Informalities Noted by Draftsperson on form PTO-948.

All changes to the drawings, other than informalities noted by the Draftsperson, **MUST** be made in the same manner as above except that, normally, a highlighted (preferably red ink) sketch of the changes to be incorporated into the new drawings **MUST** be approved by the examiner before the application will be allowed. No changes will be permitted to be made, other than correction of informalities, unless the examiner has approved the proposed changes.

Timing of Corrections

Applicant is required to submit acceptable corrected drawings within the time period set in the Office action. See 37 CFR 1.185(a). Failure to take corrective action within the set (or extended) period will result in **ABANDONMENT** of the application.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Application Publication 2001/0029111 A1 (**You et al.**).

Regarding claim 1, **You** discloses a method of forming a coating film in an isolated process chamber which allows spin-on of low dielectric materials, solvent evaporation and curing, all under a controlled environment comprising,

applying a raw material of low dielectric constant (paragraphs [0072]-[0073]) onto a surface of a plate-like material 208 (Fig. 2) to be treated;

reducing the oxygen concentration in the atmosphere surrounding the plate-like material to be less than or equal to 1% before a surface temperature of said plate-like material to be treated rises to 200 °C (paragraph [0153]); thereafter

heating said plate-like material to be treated to a temperature greater than or equal to 400 °C (paragraphs [0146]-[0147]); and then

maintaining the oxygen content in the atmosphere to be less than or equal to 1% until the surface temperature of said plate-like material to be treated lowers to 200 °C (paragraph [0153]).

Note paragraph [0153] states, “The combination of step-ramp curing and an **inert gas environment for heating, high temperature cure, and cooling steps** can provide thin films

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with high mechanical strength and minimized oxidation, therefore leading to thin films having lower dielectric constants, such as below about 3.0." (Emphasis added.) Accordingly, the heating, curing, and cooling steps in the above-mentioned paragraphs are carried out in an atmosphere of 0% oxygen because an "inert atmosphere" is used. Note also that the same purpose for using the no/low-oxygen environment in **You** is the same as that indicated by Applicant. (See instant specification section entitled "SUMMARY OF INVENTION.")

Regarding claim 2, Fig. 1a shows purging gas lines 130 to control the chamber atmosphere. Nitrogen gas as the inert atmosphere is disclosed in paragraph [0153].

Regarding claim 9, see paragraphs [0072]-[0073] and [0139].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 3, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of US 5,431,700 (**Sloan**).

The prior art of **You**, as explained above, teaches all of the features of the claims except for controlling the surface temperature of the wafer by selectively moving the wafer relative to a hot-plate positioned over a cold plate (claims 3 and 7) while the moving is carried out by a elevator means extending through the cold plate (claim 8), as shown in Applicant's Fig. 2.

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Sloan teaches a method of controlling the surface temperature of a semiconductor wafer **12** (plate-like material) for heating and for cooling operations using a hot plate **26** positioned over a cooling plate **42** with elevator means **70** having pins **62** extending through the cooling plate (cover Fig.; paragraph bridging cols. 4-5).

It would have been obvious to one of ordinary skill at the time of the invention to use the temperature control method taught by **Sloan** in the method disclosed by **You** for the many beneficial reasons indicated in **Sloan**, such as uniform heating, reduced contamination, etcetera. (See **Sloan** Abstract.)

Although each of the structural features of Applicant's claims is taught in **Sloan**, note that it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. See *Ex parte Pfeiffer*, 1962, C.D. 408 (1961). Accordingly, Applicant should phrase the claims having apparatus structure, such that the structural elements are manipulative of the method.

8. Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of either of Applicant's admitted prior art (**AAPA**) and **Wolf**, Silicon Processing for the VLSI Era, Vol. 2 : Process Integration, Lattice Press: Sunset Beach, CA 2000, pp. 797-801.

The prior art of **You**, as explained above, teaches all of the features of the claims except for further processing an interlayer insulation layer by a damascene method.

Each of **AAPA** and **Wolf** teaches the reasons it is common in the art to process an interlayer insulation layer of low dielectric constant by a damascene method, in order to

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interconnect semiconductor devices. (See instant specification, section entitled "Description of Prior Art" and associated Figs. 1(a)-1(h). See also **Wolf**, pp. 797-801 -- especially Fig. 15.60).

It would have been obvious to one of ordinary skill at the time of the invention to process the interlayer insulation film of **You** by a damascene method as taught by either of **AAPA** and **Wolf** in order to form interconnect for semiconductor devices, which is essential in the art and because the **You** method is for the formation of, *inter alia*, interlevel dielectrics for semiconductor devices (Abstract; paragraph [0009]).

Regarding claim 10, **You** discloses that the interlayer insulation film beneficially has a low dielectric constant of 3.0 or less, as noted above.

9. Claims 5-6 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **You** in view of **Sloan** as applied to claims 1-3 above, and further in view of either of **AAPA** and **Wolf**.

The prior art of **You**, as explained above, teaches all of the features of the claims except for further processing an interlayer insulation layer by a damascene method.

Regarding claims 5 and 6, either of **AAPA** and **Wolf** is applied as above.

Regarding claims 11-12, **You** discloses that the interlayer insulation layer beneficially has a low dielectric constant of 3.0 or less, as noted above.

Response to Arguments

10. Applicant's arguments filed 17 July 2002 have been fully considered but they are not persuasive.

In the paragraph bridging pages 2-3 of the Response filed 17 July 2002, Applicant argues that You “fails to teach the temperature-based limitations set forth in claim 1. Particularly, claim 1 defines that the oxygen concentration in the atmosphere surrounding the material to be treated is reduced to $\leq 1\%$ *before the surface temperature of the material rises to 200 °C*, and is maintained at such level while the material is heated to $\geq 400\text{ °C}$ and then lowered to 200 °C.” (Emphasis in original.) Further in this regard, Applicant states in the next paragraph that “while You’s disclosed method(s) involve use of an inert atmosphere ($\leq 1\%$ oxygen) during the curing stages of his coating film formation, as noted by Examiner with reef to paragraph [0153] of You’s disclosure, such curing stages at his paragraphs [0143]-[0152] are disclosed as *starting at temperatures above 200 °C*.” (Emphasis in original.)

Examiner respectfully disagrees. Paragraph [0153] of You states,

“It is also desirable to perform the curing steps in an atmosphere of an inert gas, such as nitrogen, argon, neon, helium, or other noble gas. The **combination** of step-ramp curing **and** an inert gas environment for **heating**, high temperature cure, and **cooling** steps can provide thin films with high mechanical strength and minimized oxidation, therefore leading to thin films having lower dielectric constants, such as below about 3.0.” (Emphasis added.)

Accordingly, it is clear that not only is the You curing step of the SOG is in an inert environment, but also the heating and cooling steps. For this reason, Applicant’s argument that You only uses the inert environment for the curing step and therefore does not use the inert atmosphere during the heating step to 200 °C is contrary to the facts of record. Additionally, in the paragraphs [0143]-[0152] of You, as indicated by Applicant, are directed to such heating steps which occur clearly at temperatures below 200 °C, prior to the curing which provides further evidence that indicates that the environment is inert at temperatures below 200 °C.

The remainder of Applicant's arguments are premised upon the alleged failure of You to teach the claimed invention. For the reasons already stated, Examiner respectfully disagrees. Accordingly, all arguments have been addressed.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the

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organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Erik Kielin

March 22, 2003